State of Kuwait
Ministry of Guidance & Information
Kuwait 1963

THE STORY OF WATER IN KUWAIT

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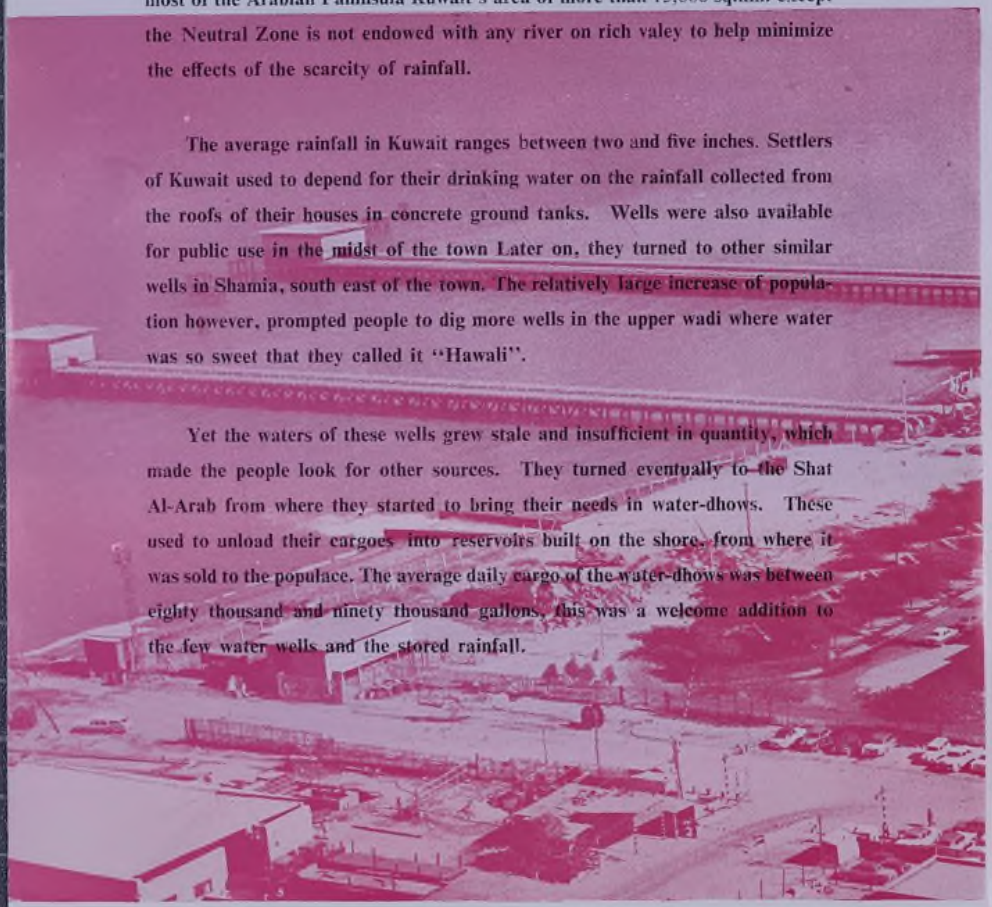
Water in Kuwait

INTRODUCTION

The territory of Kuwait is but a continuation of the great desert that covers most of the Arabian Paninsula Kuwait's area of more than 15,000 sq.km. except the Neutral Zone is not endowed with any river on rich valey to help minimize the effects of the scarcity of rainfall.

The average rainfall in Kuwait ranges between two and five inches. Settlers of Kuwait used to depend for their drinking water on the rainfall collected from the roofs of their houses in concrete ground tanks. Wells were also available for public use in the midst of the town Later on, they turned to other similar wells in Shamia, south east of the town. The relatively large increase of population however, prompted people to dig more wells in the upper wadi where water was so sweet that they called it "Hawali".

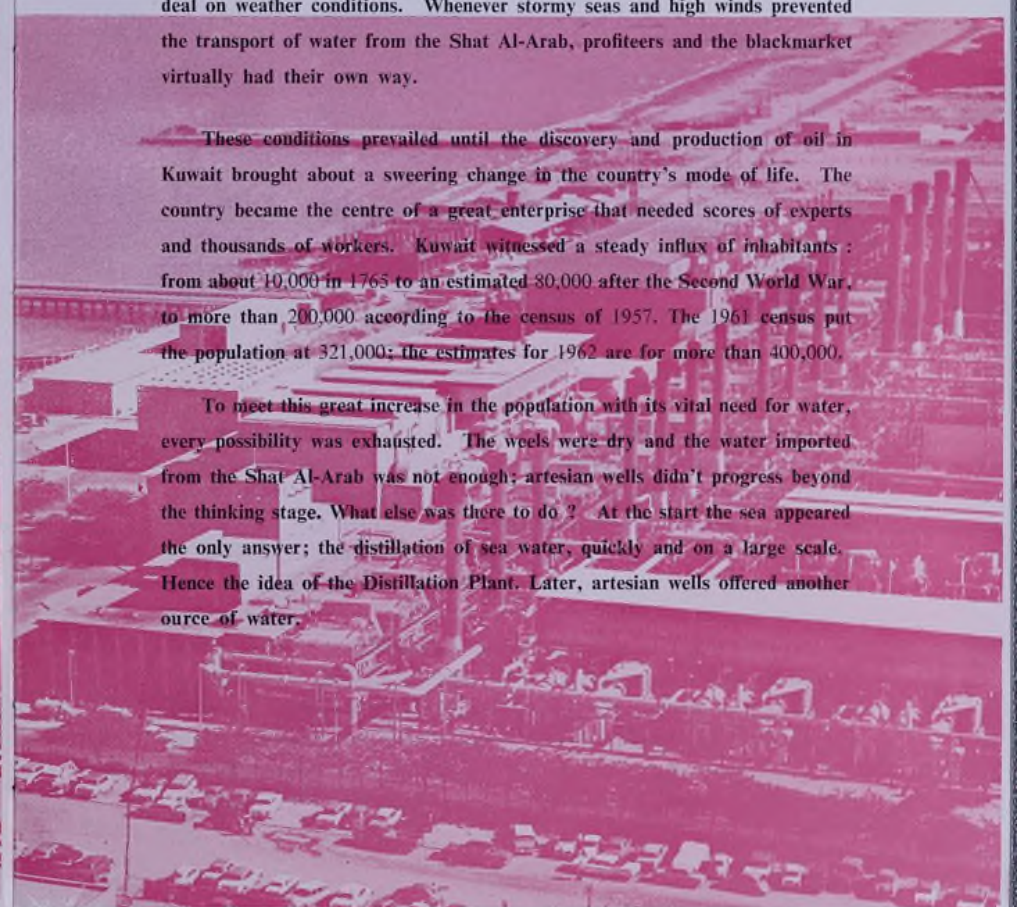
Yet the waters of these wells grew stale and insufficient in quantity, which made the people look for other sources. They turned eventually to the Shat Al-Arab from where they started to bring their needs in water-dhows. These used to unload their cargoes into reservoirs built on the shore, from where it was sold to the populace. The average daily cargo of the water-dhows was between eighty thousand and ninety thousand gallons, this was a welcome addition to the few water wells and the stored rainfall.



These various sources still didn't provide Kuwait with water that was free of impurities; and the water imported from Shat Al-Arab depended a great deal on weather conditions. Whenever stormy seas and high winds prevented the transport of water from the Shat Al-Arab, profiteers and the blackmarket virtually had their own way.

These conditions prevailed until the discovery and production of oil in Kuwait brought about a sweering change in the country's mode of life. The country became the centre of a great enterprise that needed scores of experts and thousands of workers. Kuwait witnessed a steady influx of inhabitants : from about 10,000 in 1765 to an estimated 80,000 after the Second World War, to more than 200,000 according to the census of 1957. The 1961 census put the population at 321,000; the estimates for 1962 are for more than 400,000.

To meet this great increase in the population with its vital need for water, every possibility was exhausted. The weels were dry and the water imported from the Shat Al-Arab was not enough; artesian wells didn't progress beyond the thinking stage. What else was there to do ? At the start the sea appeared the only answer; the distillation of sea water, quickly and on a large scale. Hence the idea of the Distillation Plant. Later, artesian wells offered another ource of water.



1 SWEET WATERS

A. THE DISTILLATION PLANT

Construction and Capacity — When H. H. the Amir conceived the idea of establishing the first power station as a part of the development plans, he also ordered the construction of sea water distillation plants to secure the needed quantities of fresh water for Kuwait. In 1952, bids were invited for the construction of the Shuwaikh Distillation Unit and it was completed in March 1953.

The Unit consisted of ten distillators, each producing 100,000 gallons of distilled water a day, totalling a daily production of one million gallons of sweet water. A net-work of pipelines connecting the distillation unit to high water towers was decided to be established for a subsequent piped water supply to private houses. The construction of the water towers has been completed.

A part of the power and water distillation plant

In February 1955, the second distillation unit with another one million gallons of production was completed. It also consists of ten distillators, each producting 100,000 gallons daily.

But the expansion which covered every aspect of life in Kuwait was so great that the demand for more water became still greater. The then Department of Electricity invited other bids for the construction of a third distillation unit, with a production of two million gallons a day. The first part of this unit was completed in October 1957; and the second part in March 1958. This Unit consists of four distillators, each with a production of 500,000 gallons a day. The new distillators are flash-type which save labour and occupy less surface space because they are taller than the order types,

Thus in 1959, four million gallons of fresh water being distilled in

Kuwait. But the need was still rising and the consumption was steadily going up. The Ministry of Electricity and Water — Electricity Department then — took measures for securing bigger reserves still. A fourth distillation unit with a capacity of two million gallons a day went under construction. This was a newer type with two distillators only, each producing one million gallons daily. This new unit, which was completed in the summer of 1960, is so designed as to consume a minimum amount of energy.

Six million gallons of fresh water a day was then found to be sufficient. It made the people of Kuwait secure and free of the worry that lack of water engendered. It also reased them from the clutches of the profiteers which had so plagued them in the past.

The Ist. distillation unit commissioned in March 1953

A pumping station and a Jetty of the distillation plant

DISTILLATION PROCESS

The pipes through which the sea water is pumped to the distillation unit go out for 600 feet into the bay, this makes pumping independent of the tides. Sea water, with salt content of 4.3% is passed to a reservoir where it is mixed with chlorine to prevent the growth of marine life in the pipes and tanks which might cause them to clog. The water is then passed through cylinderical filters before flowing in cement pipes to the distillation plant. After distillation salt content in the remaining water is 8.8%, this water is pumped back into the sea.

The distilled water is mixed with 5 — 7% brackish water from springs to give it the taste of natural water and supply essential salts. The ratio is variable.

DEVELOPMENT OF WATER PRODUCTION

In the last nine years, the production of sweet water in Kuwait has undergone a tremendous change. The following table shows the total annual production from 1953 to 1962, the average daily production, percentage of increase annually and also the relative annual increase since 1955 :

Year	Total annual production Gallons	Annual Percentage of increase since 1955	Percentage of increase since 1955	Average daily production Gallons
1953	115,758,321	—	—	322,000
1954	234,209,019	—	—	641,000
1955	362,135,679	—	—	992,000
1956	521,115,443	44	44	1,427,000
1957	671,151,290	29	85	1,838,000
1958	936,501,870	39	158	2,565,000
1959	1,198,704,080	28	231	3,284,000
1960	1,408,129,530	17	289	3,857,000
1961	1,601,618,980	14	342	4,387,000
1962	1,680,044,080	4,9	364	4,602,000

Steam Turbine generators at the distillation plant

WATER DISTRIBUTION

Immediately after distillation the water is pumped to six ground — level reservoirs in different parts of Kuwait where it is mixed with brackish water to acquire the natural taste. The water then flows to 14 distribution stations whence water tankers transport it to homes.

The following tables show fresh water reservoirs and towers, their capacities and distribution stations :

Ground — Level Reservoirs for Fresh Water from the Distillation Unit

District	Number	Capacity (Imperial gallon)
Shuwaikh	1	3,000,000
Shuwaikh	1	3,000,000
Shuwaikh	1	10,000,000
Hawalli	1	10,000,000

SWEET WATER TOWERS

District	Number	Capacity (Imperial gallon)
Sha'b Gate	1	160,000
Industrial Area	1	160,000
Kifan	1	500,000
Hawalli	1	500,000
Salmiyah	1	416,000
Farwaniyah	1	250,000
TOTAL	6	1,986,000

Overhead water Storage tank

FRESH WATER DISTRIBUTION STATIONS

Serial No.	District	Number
1	Sha'b Gate	2
2	Green Belt	1
3	Industrial Area (Harbour Dist.)	1
4	Bitumen Mixing Plant	1
5	Industrial Area (Ahmedi Road)	1
6	Farwaniyah	1
7	Garden (old airport)	1
8	Research	1
9	South Shuwaikh	1
10	Salmiyah	1
11	Education Garage	1
12	Housing Station	1
13	Jahra Station	1
	TOTAL	14

Water tankers for distribution to houses number around 2,500; each one with a capacity of 750 - 2,000 gallons. A few water tankers have a capacity of 5,000 gallons, these transport sweet and brackish waters.

A distillery at the plant

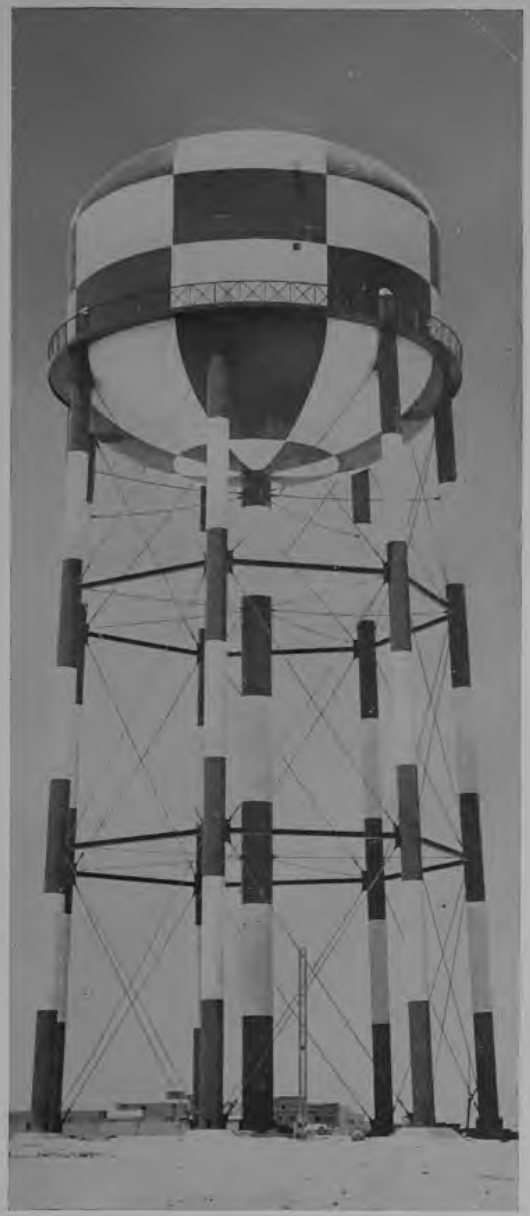
COSTS AND SELLING PRICES

The production costs of water distillation in Kuwait are much lower than anywhere else in the world. This is because of the use of natural gas from oil fields, which costs practically nothing, to generate energy. Gas pipelines are rarely put out of action; but when they are then diesel fuel is used. Thirty million cubic feet of natural gas are used in the distillation process every 24 hours.

The production of sweet water by distillation costs 1.96 dollars per one thousand gallons in the Morro Bay Station on the west coast of the U.S. The costs are 1.75 dollars in Europa Island in the Caribbean; and 1.75 dollars in Kuwait. But the costs of production from the new distillation units are never more than one dollar per thousand gallons.

Because of the cost of transportation retail prices of sweet water vary according to the distance from the distribution station. Generally the present average retail price is KD.1.5 per thousand gallons. The Government has put a fixed price on water. Distribution stations sell water at 600 fils per thousand gallons.

Water Tankers at a Water Filling Station

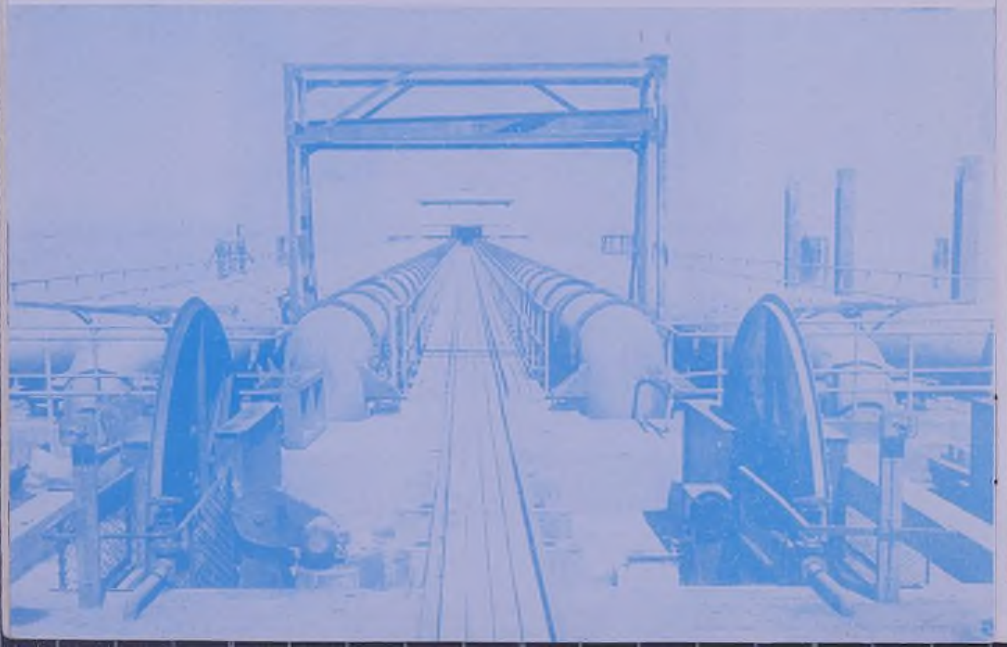


Another Sample of Water Towers

A Sideview of a distillery

A painting representing a boat formerly used for water haulage from (Shatt al Arab). A contribution to the 3rd. Spring Exhibition of fine arts in Kuwait, by Abdel - Hamid al Saleh - a Kuwait artist.

Only clean sea water is allowed for distillation. Marine life, herbs of foreign elements are removed by filters as in this photo



Some of the Cabinet and National Assembly Members visiting an experimental Well at Raudhatain

Raudhatain Water

RAUDHATAIN WATER

The Raudhatain water field was discovered between the Raudhatain Oil Field to the west and the Basra road to the east. The centre of this field is 56 km. north of Jahrah and 18 km. south of the Iraqi border it is about 88 km. from the city of Kuwait.

DISCOVERY

Chance played a part in the discovery of the Raudhatain water Field. It was in May 1960 whilst the Ministry of Electricity and water was fulfilling its commitments in supplying the Basrah Road contractor with brackish water and digging wells for that purpose, that one of the six wells that were drilled showed a very small salt content. It was then concluded that the

(And We Made From Water Every Living Thing)

« The Glorious Quran »

Experts on their first phase of Al - Raudhatain project

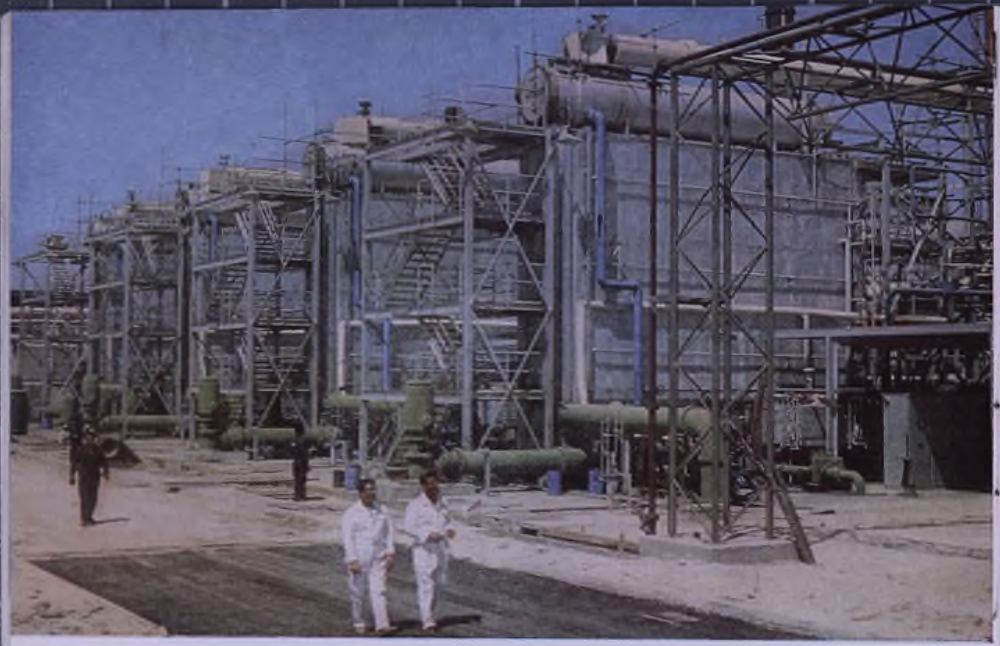
surrounding area might contain sweet water. Subsequently, three holes were drilled, one of which — No. 8 — contained sweet water. For the next two months, while water was pumped out continuously from that well, no change

of taste or quality was noticed, nor did the strength of the well diminish.

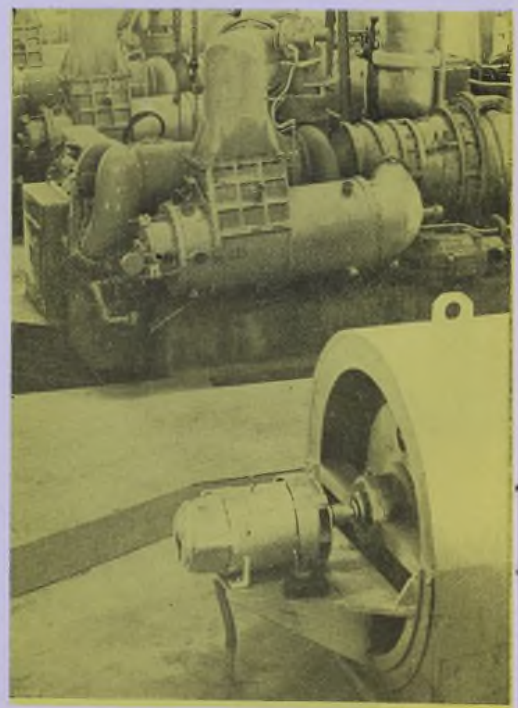
These results made the Ministry of Electricity and Water contract an international company (Parsons Engineering and Development) to make a completes survey of the Raudhatain area. The company drilled 65 holes and ran in casings 3 - 5 inches in diameter to control sampling and testing. The consultants were thus able to verify the water formations, their thicknesses and the qualities of waters available. The results were encouraging.

The Government of Kuwait was encouraged by the results to extract the waters and make use of it. A drilling programme of 12 wells was

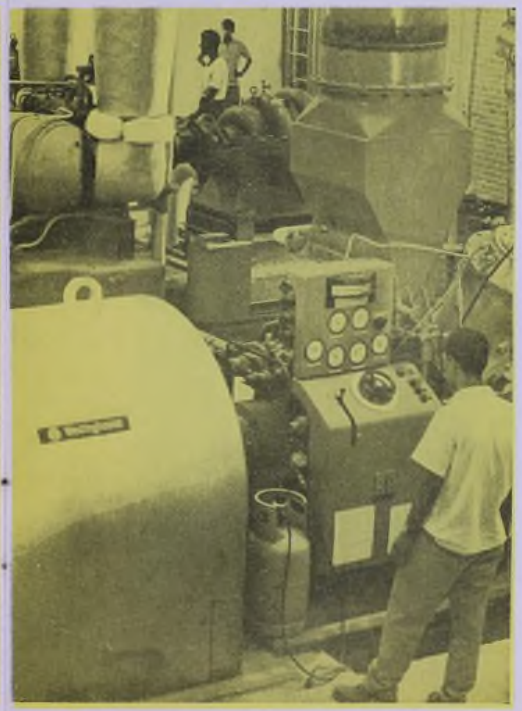
Laying of water pipelines feeding Kuwait



« *Flash* » *type distillation units, designed to occupy the minimum of land for the maximum of production, were commissioned in march* 1958



A partial view of water pumps and electrical energy generators at al-Raudhatain.



After distillation, remaining water is discharged into the sea

then put into action whose aim was to produce six million gallons of fresh water daily; each well producing ½ a million gallons a day. This was part of whatcame to be called the Raudhatain Water Scheme. Briefly, this is what happened :

* The first sweet water well was discovered in the Raudhatain area in May 1960 (Well No. 8).

* In October 1960, the Ministry contracted an international consultants firm to make a complete and detailed survey of the area and to search for water.

* The consultants completed their report and gave it to the Government in March 1961. The report defined the area and volume of reserve in the reservoir and also its potentialities.

* The Government approved in May 1961 the report of the Ministry of Electricity and Water containing the estimates for costs and the volume of water to be pumped out of the Raudhatain Field. The middle of December 1962 was fixed as a date for the arrival of the Raudhatain water in Kuwait.

* The Ministry went ahead in the execution of the scheme in June 1961, after putting it to international tender.

* The scheme was completed and the Raudhatain waters arrived in the City of Kuwait on the 19th of September 1962.

THE QUALITY OF THE WATERS

The water of these wells is of a very good quality; it contains only 625 parts of salts per million. But the quality differs from one well to another; while in some wells the salt composition is 300 parts per million, in others it rises to 1,300 parts; but the resulting mixture gives an average of 625 parts per million.

Pipe laying operations from al Raudhatain to Kuwait town, in progress

AREA AND WATER FORMATIONS

Area and Water Formations :

The area of the field is about fifty square kilometers; it is rectangular in shape with a breadth of about 4 - 5 km. and a length, running north to south, of about 12 km.

The surface of the field is actually a wide depression in which the rainfall gathers in the winter season. In 1951 there were 3 feet of water in the depression for several weeks.

The lowest point in the surface of the field is 114 feet above sea level. There are many wadis that feed the depression in the rainy season; many of these wadis carry a great deal of rain water.

Water formations in the field are a mixture of sand and porous gravel which allow the water to rise to the surface on pumping. There are three layers of water one upon the other separated by layers of hardened smooth soil. The upper layer starts at 90 feet deep from the middle of the field; its thickness is between 30 and 60 feet. The thickness of the second layer of water is 10 - 15 feet. The lowest layer has a thickness of 20 to 80 feet.

Water is pumped out from the underground huge reservoirs to the diverse points of distribution.

The upper layer of water is the main reservoir because of the abundance of sweet water in it. The three layers are surrounded by salty waters in some parts, which require particular care in pumping.

THE SOURCE OF THE RAUDHATAIN WATERS

The Raudhatain waters are the product of rainfall which has seeped into the ground during the modern geological era (thousands of years); the process is still going on. It is also possible that in the ice age, when rainfall in the Kuwait area was much higher, great volumes of rainfall seeped into the ground and forced the salty layers further down. Sweet water is still being added today. It has also been noticed that the sweet waters move slowly to the North and North East, forced by the pressure of water coming from the South. The volume of water added to the reservoir daily that is moving northwards is estimated at one million gallons a day.

STORAGE OF RAINWATER

Engineering consultants are designing an artificial reservoir for rain-water storage to study the best ways of control and preservation. The reservoir is fed by a number of channels that pour into a large ditch before going through a sand filter into the reservoir.

The reservoir is steel encased, equipped with valves which allow the water to reach the reserves. It is hoped that the life of the Raudhatain Water Field will thus be extended by the use of such a method. The experts will

Work on the Raudhatain water pipeline

carry out further studies of the field when pumping becomes continuous.

Productive Wells :

Twelve wells in Raudhatain Field have been put into production; the average depth of each well is between 140 and 225 feet. Each well has a 12 inches steel casing which is resistant to rust. The length of each well pipe varies from 25 to 60 feet; it is equipped with filters and surrounded by screened gravel.

The productive capacity of each well is 150 - 400 gallons per minute. But the well will not be worked to capacity in order to draw water in a practical and effective way and to conserve the field. For example, there is a well with a capacity of more than one thousand gallons a minute some (1½ million gallons a day); but the pumping rate is much less than this.

The top of the still water layer in the field is 90 feet under-ground; pumping may be 15 or 20 feet deeper than this. The productive capacity of all wells is about five million gallons a day. This quantity affords for the total consumption need of Kuwait.

BRINGING RAUDHATAIN WATER TO KUWAIT

The water of Raudhatain would have been almost useless unless it could be brought to Kuwait for the use of the population. This is what is being done :

1. Water from the productive wells is being pumped through an asbestos pipeline 7 km. long to the main reservoir built of steel and concrete. This has a capacity of 7½ million gallons.

2. Water is pumped from the main reservoir to Mutla' whence it flows to Kuwait by the force of gravity.

3. The pumping station has its own power station which has two sections:

   (*a*) One to generate electricity and pump water from the wells to the main reservoir and for local consumption in Raudhatain; it has four gas turbines of 400 kilowatt each.

   (*b*) The second part is for pumping water from the main reservoir to Mutla'; it has three gas turbines of 900 H.P. each.

4. The length of pipeline from Raudhatain to Kuwait is 88 km.; 53 km, of which is from Raudhatain to Mutla', with a diameter of 24 inches; and 35 km. from Mutal' to Kuwait with a diameter of 26 inches. It lies under ground.

5. Permanet offices and wellings were built for employees permanently employed in the wells area. A wireless system provides continuous communication with Kuwait.

6. There is a small workshop for maintenance.

7. A group of technicians have been trained abroad in the operation and maintenance of the gas turbines.

The water of Raudhatain opened a new page of security in the story of progress and development in Kuwait.

Electric generators and water pumps at Al - Raudhatain station

Fresh water gushed out quenching thirst of the Bedouins in the area, and their animals

A view of another distillation unit commissioned in February 1955

2 BRACKISH WATERS

The Government of Kuwait took an interest in brackish waters as early as 1951. This water is useful for domestic and agricultural purposes. Brackish waters were found in an area fifteen kilometers away from the City of Kuwait known as Sulaibiyah. These waters which contain 4,000 parts of salts per million, and which are called Sulaibiyah waters, can be used in agriculture.

DEVELOPMENT OF PRODUCTION

The Government found that this water could reduce a part of the demand on sweet water and could be used to encourage an expansion in agricultural activities. In 1951, three brackish water wells were put into production with a capacity of 450,000 gallons per day. By the end of 1962, the number of wells had jumped to about 90 and this number is expected to reach one hundred by the end of 1963 when the production will be in the order of 18 million gallons daily. This is thought sufficient to meet the expected demand in the summer of 1963.

The highest daily production was reached in the summer of 1962, when 65 productive wells out of seventy gave twelve million gallons daily. The expected increase and expansion in 1963 will be the result of direct distribution after the completion of a network of pipelines reaching homes in many parts of Kuwait. The network will cover most parts of Kuwait in less than two years.

Following is a table for the production development until 1962 :

Year	Annual total production in gallons	Daily Average	Annual percentage of increase	Annual percentage of increase with 1954 as base
1954	187,923,000	514,000	—	—
1955	252,723,000	629,000	34	34
1956	376,814,200	1,032,000	49	100
1957	538,636,000	1,475,000	43	186
1958	817,642,000	2,240,000	53	335
1959	1,185,195,000	3,247,000	44	530
1960	1,529,025,000	4,189,000	29	713
1961	1,886,034,000	5,167,000	23	900
1962	2,968,991,000	8,134,000	57	1480

DISTRIBUTION

The waters of Sulaibiyah reach Kuwait through a network of pipelines which branch out from a three-million-gallon reservoir in Sulaibiyah. The water flows from the Sulaibiyah reservoir to many tanks in the Shuwaikh area. These are 80 feet lower than the Sulaibiyah reservoir. From Shuwaikh, the water is pumped to various distribution areas and to the tanks of Hawalli which are lower than the Shuwaikh tanks by 40 feet. Four pipelines of asbestos carry the water from the Sulaibiyah reservoir.

* The first pipeline from Sulaibiyah to Shuwaikh was laid in 1954; it is 17.2 km. long and 18 inches in diameter.

* A second similar one was completed in 1958.

* The third which was completed in 1960 has a diameter of 24 inches.

* The fourth is similar to the third and was completed in 1962. These four pipelines have a throughput capacity of twenty million a day.

Following are tables for storage and distribution of brackish waters :

Ground-level Storage Tanks for Brackish Water

District	Number	Capacity (Imperial gallons)
Shuwaikh	1	3 ·000 ,000
Shuwaikh	1	5 ,000 ,000
Hawalli	1	5 ,000 ,000
Sulaibiyah	1	3 ,000 ,000
Total	4	16 ,000 ,000

Brackish Water Towers

District	Number	Capacity (Imperial gallons)
Sha'b Gate	1	160 ,000
Industrial Area	1	160 ,000
Kaifan	1	500 ,000
Hawalli	1	500 ,000
Salmiyah	1	416 ,000
Farwaniyah	1	208 ,000
Total	6	1 ,944 ,000

Brackish Water Distribution Stations

Serial No.	Area	No.
1.	Green Belt	1
2.	Bitumen Mixing Plant	1
3.	Industrial Area (Ahmadi Road)	1
4.	Farawaniyah	1
5.	Garden (Old airport)	1
6.	Research	1
7.	Salmiyah	1
	Total	7

Distribution is not limited to these stations; brackish water now reach directly North Shuwaikh, South Shuwaikh, District (B), Shamiyah, Keifan, Dasmah, Qadisiyah, and Faiha'. Direct lines are expected to feed the following areas in 1963 : — Dai'ah, Sha'b, Hawalli, Nugrah, Salmiyah, Shuwaikh Industrial Area, Benid Al-Qar and all the other areas which are covered by town planning.

The retail prices of brackish water are 100 fils per thousand gallons and 50 fils for agricultural purposes, exclusive of transport costs.

CONCLUSION

It is evident that water in Kuwait is no longer the problem that it once was. The citizen is no longer at the mercy of profiteers and blackmarketeers or at the mercy of weather conditions.

It will not be very long either before water is piped directly into the home. No one will need to buy water from water tankers. This new project of connecting homes directly to the water supply will start in 1964.

The story of water in Kuwait is in itself a great tribute to the deligent work and sincere efforts of the Government of H.H. the Amir and to his wise guidance.

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